

# Beowulf Database Option

Robert Schaefer  
GLAST SSC

- DBMS (PostgreSQL, Oracle, Sybase, etc.)
- Beowulf
- Other options not thought of yet...

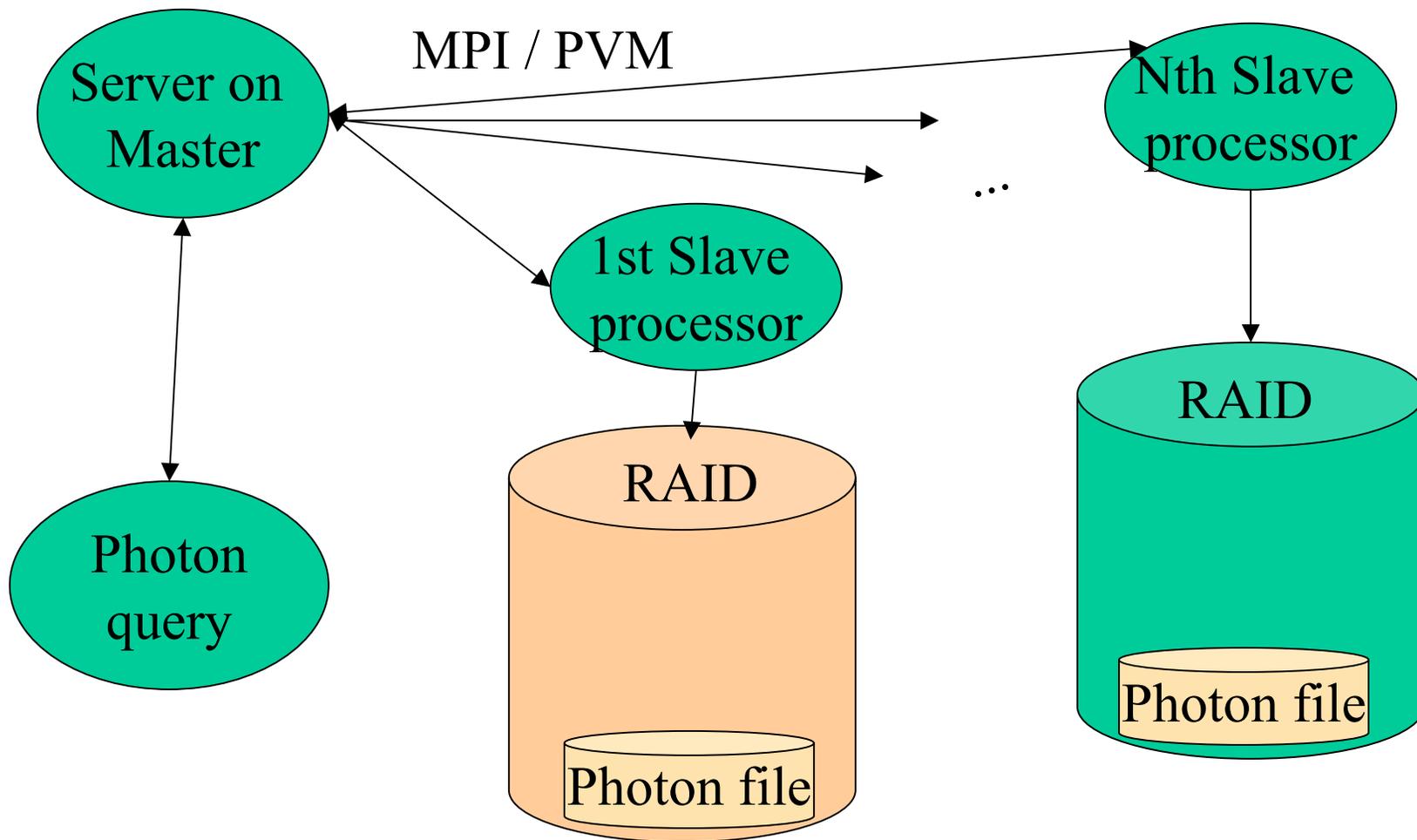
- A little about Beowulf Clusters
- Simple architecture used in prototype
- Performance
- Improvements
- Conclusions

- Cluster of low cost mass market computers
- Tied together with a message passing interface (usually MPI or PVM) and synchronization/management tools
- Memory is not shared.
- Pioneered by people at GSFC

- Effective parallelization means that the photons are sorted randomly.
- If spatial searches are most important, can store them in time order (or use a hash function).
- No need to build and maintain a large index, just store metadata.

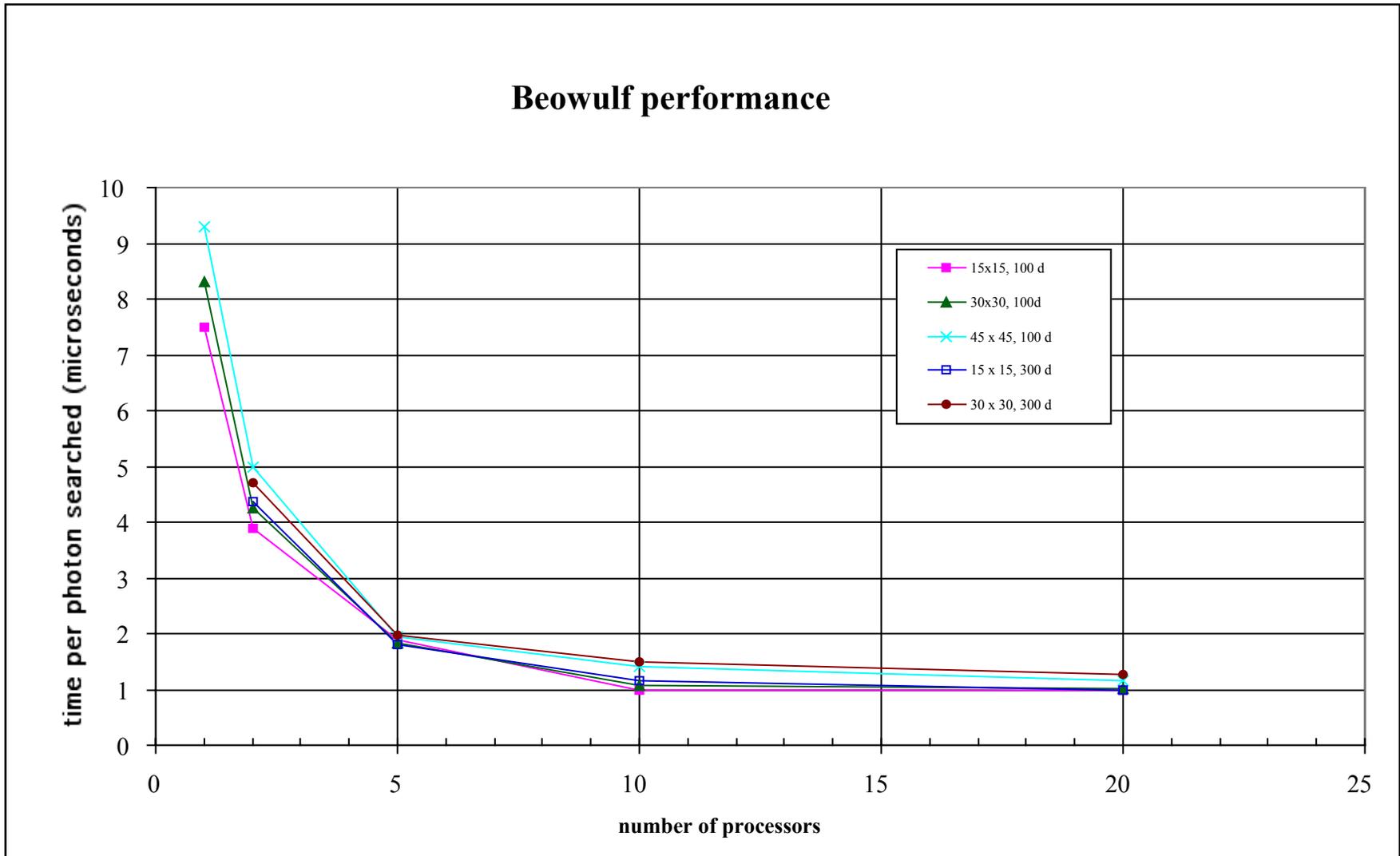
- Original FITS files from level 1 processing kept on disk
- Ingest of new data - copy new file to disk
- Reprocessing - replace FITS file on disk

# Simple Beowulf Photon DB

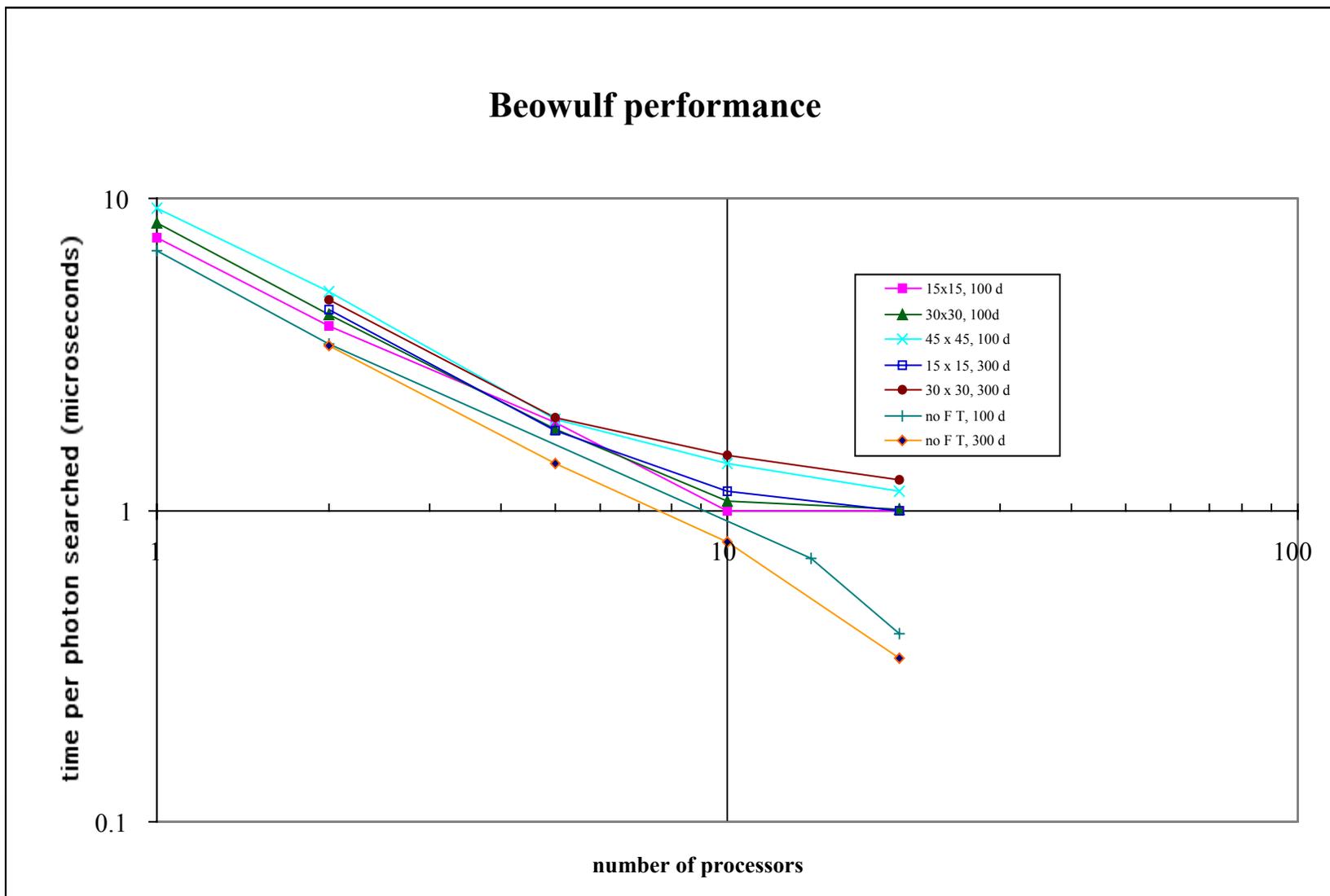


- Prototype architecture
  - Query all photons in a region
  - Master tells slaves which files to search
  - Slaves search files, make FITS file of queried photons.
  - Slaves send resultant files back to master.
- Tested searching boxes in galactic coordinates using simulated GLAST data (Seth Digel)

# Prototype Performance Times

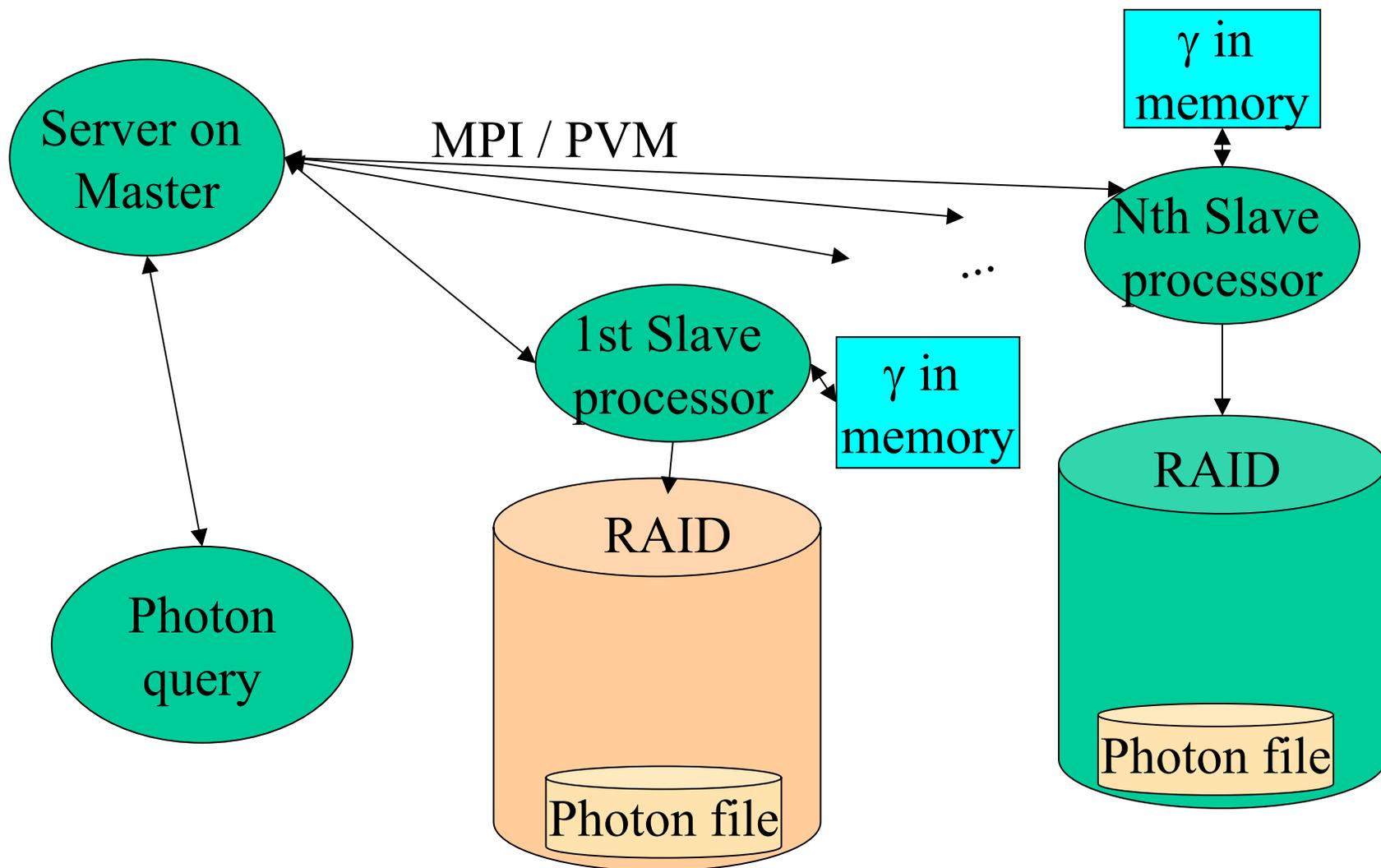


- Searches can be done at  $\sim 1$  microsecond per photon.
- With 1 G photon database (after 10 years), search can be done in  $1000 \text{ s} = 17 \text{ min}$ .
- Requirement is  $\leq 30 \text{ min./year}$  data searched.



- 1st bottleneck is inefficient file transfer to master
  - Gigabit ethernet
  - more efficient file transfer algorithm
- 2nd bottleneck is disk access times
  - Store photons in memory
  - 40 nodes w/ 5 Gb gives 200 Gb storage.
- Could possibly get a factor of  $\sim 30$  improvement
  - Entire database searched in 30 seconds.

# Improved Beowulf Photon DB



<b>DB Attribute</b>	<b>Beowulf</b>	<b>DBMS</b>
Querying Times	No query intrinsically longer than another	Spatial queries fast, but complicated joins may be long
Reprocessing / Update Times	Easy replace/add file, read new file	Find and delete old photons, ingest new
Programming Times	Requires Beowulf programming up front	Uses COTS

- Beowulf can meet our needs and much more
- Beowulf database architecture is simple, but all code must be custom.
- DBMS can likely meet our needs as well.
- Must choose architecture makes the most sense.